Dr.m.w.p.w.s.arts and commerce college

***Question bank for* M.Com. (Part–IV)**

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OPERATIONS RESEARCH

Q.1:- Consider the following problem and solve graphically ;-

Minimise :-

$Z = 2x_1 + 4x_2$

Subject to:-

$x_1 + x_2 \leq 14$ $\quad 3x_1 + 2x_2 \geq 30$

$2x_1 + x_2 \leq 18$ $\quad x_1 , + x_2 \geq 0$

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Q.2:- Kashamira Company has four projects, to which the want to assign four persons. Each project must be assigned to only one person. The cost of assigning the person to various projects is as given below ;-

Persons	**Project**			
	A	**B**	**C**	**D**
1	6	12	3	7
2	13	10	12	8
3	2	5	15	20
4	2	7	8	13

Find the best assignments.

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Q.3 :- The following data relate to a particulars item in stock.

Normal usage	110 per day
Minimum usage	140 per day
Maximum usage	50 per day
Lead time	25-30 days
EOQ	5000 units (calculated earlier)

Using the data, calculate the Re-order, Minimum Maximum and Average levels.

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Q.4 :- A small project consists of eight activities has the following characteristics :-

Activity	**Preceding Activity**	**Duration (Weeks)**
A	None	5
B	None	14
C	A	9
D	A	15
E	A	8
F	B, C	9
G	D	4
H	EFG	5

(a) Draw the network for the project.
(b) Determine the critical path.
(c) Prepare the activity schedule for the project.
(d) Find total, free and independent float.

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Q.5 :- A bakery keeps stock of a Sundar brand of cakes. Previous experience shows the daily demand pattern for the item with associated probabilities as given below :-

Daily Demand (Nos.)	Probability
0	0.01
10	0.20
20	0.15
30	0.50
40	0.12
50	0.02

Use the following sequence of random numbers to simulate the demand for next 10 days.

Also find out the average demand per day. Random Nos. : 25, 39, 65, 76, 12, 05, 73, 89, 19, 49.

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Q.6 :- Solve the following transportation problem for minimum cost :-

Origins	Destinations				Availability
	I	II	III	IV	
A	7	3	5	5	34
B	5	5	7	6	15
C	8	6	6	5	12
D	6	1	6	4	19
Requirement	21	25	17	17	

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Q.1 :- Calculate the minimum total transportation cost by using Vogel's approximation method :-

Factory	Matrix Warehouse				Supply
	A	B	C	D	
I	1	5	3	3	34
II	3	3	1	2	15
III	0	5	2	3	12
IV	2	7	2	4	19
Demand	21	25	17	17	

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Q. 2 :- Solve linear programming problem by graphic method :-

Maximize :-

$Z = 6x_1 + 7x_2$

Subject to :-

$2x_1 + 3x_2 \leq 12$

$2x_1 + x_2 \leq 8$

$x_1 , + x_2 \geq 0$

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Q.3:- A team of 5 horses and 5 riders has entered a jumping show contest. The number of penalty to be expected when each rider rides any horse is shown below :-

Horse	Rider				
	R_1	R_2	R_3	R_4	R_5

H_1	5	3	4	7	1
H_2	2	3	7	6	5
H_3	4	1	5	2	4
H_4	6	8	1	2	3
H_5	4	2	5	7	1

How should the horses be allotted to the riders so as to minimise the expected loss of the team?

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Q.4 :- Two firms are competing for business. Whatever Firm A gains, Firm B loses. The table given below shows advertising strategies of both firms and the utilities to firm A for various market shares in percentages (assuming this to be a zero sum game) :-

Firms A's utility

Firm A	**Firm B**		
	Press	**Radio**	**T.V.**
Press	60	75	40
Radio	75	75	60
T.V.	80	60	70

Find optimal strategies for both firms and expected percentage of market shares to firm A.

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Q.5 :- A small project is composed of seven activities whose time estimates are given in the following table:-

Activity	**Event**	**Optimistic**	**Most Likely**	**Pessimistic**
A	1-2	6	6	24
B	1-3	6	12	8
C	1-4	12	12	30
D	2-5	6	6	6
E	3-5	12	30	48
F	4-6	12	30	42
G	5-6	18	30	54

(i) Find the expected duration and variance for each activity.
(ii) What is the expected project length?
(iii) Calculate the variance and standard deviation of the project length.

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Q.6 :- A Company currently replenishes the stock of a certain item by ordering enough supply to cover one month's demand. The annual demand of the item is 1500 units. It is estimated that it costs Rs.20 every time an order is placed and the holding cost per unit of inventory per month is Rs.2. In case no storage is allowed, determine :-

(a) Economics order quantity and time between two orders.

(b) Difference in annual inventory cost between optimal policy and current policy of ordering month's supply 12 times in a year.

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Q. 1 :- Solve graphically Linear Programming Problem :-
Maximize :-

$Z = 5x_1 + 4x_2$

Subject to :-

$5x_1 + x_2 \leq 50$

$2x_1 + 3x_2 \leq 90$

Whereas x_1 and $x_2 \geq 0$

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Q. 2 :- Solve the following transportation problem using Vogel's Approximation Method :-

Plants	**Warehouse**				**Supply**
	W_1	**W_2**	**W_3**	**W_4**	
P_1	13	25	12	21	18
P_2	18	23	14	9	27
P_3	23	15	12	6	21
Demand	14	12	23	17	

Determine the transportation schedule which minimize the transportation cost.

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Q.3 :- The Personnel Manager of ABC Company wants to assign Mr. X, Mr.Y and Mr. Z to regional offices. But the firm also has an opening in its Chennai office and would sent one of three to that branch if it were more economical than a move to Delhi, Mumbai or Kolkata. It will cost Rs.2,000 to relocate Mr. X to Chennai,Rs. 1,600 to relocate Mr. Y there and Rs.3,000 to move Mr. Z. What is the optimum assignment of personnel to offices? Determine total minimum cost.

Block / Hiree	**Delhi**	**Mumbai**	**Kolkata**
Mr. X	1600	2200	2400
Mr. Y	1000	3200	2600
Mr. Z	1000	2000	4600

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Q.4 :- The utility data for a network are given below ;-

Activity Code	**Activity Code**	**Duration in Months**
0-1	A	2
1-2	B	8
1-3	C	10
2-4	D	6
2-5	E	3
3-4	F	3
3-6	G	7
4-7	H	5
5-7	I	2
6-7	J	8

Determine :-

(i) Construct the network diagram.

(ii) Find the critical path and duration of completion of project.

(iii) Compute Earliest and Latest time.

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Q.5 :- A company uses annually 24000 units which cost Rs.12.5 per unit. The cost of placing each order is Rs.22.50 and carrying cost 5.4% per year of average inventory.

Find Out :-

(a) Economic order quantity.
(b) Number or orders per year.
(c) Time between two consecutive orders.
(d) Optimal cost.

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Q. 6:- The number of customer arriving in an Automotive workshop, follows the following distribution. Using Monte Carlo Simulation, find out the average number of customers arriving at the Automotive workshop :-

Number of Customers	Probability Of Arrival
0	0
1	0.1
2	0.2
3	0.4
4	0.2
5	0.1

Find the probability that a customer cannot get the proper service, because of shortage of mechanics. Assumed that 3 mechanics are working in the Automotive workshop.

(Simulate 10 Samples Random Nos.) As follows :-

6281, 4182, 1727, 8001, 9662.
6386, 7883, 1556, 9610, 5311.

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Q. 1 :- A machine producing either product A orB. It can produce product A by using 2 units of chemicals and 1 unit of a compound and can produce B by using 1 unit of chemical and 2units of the compound. Only 800 units of chemical and 1000 units of the compound are available. The profit available per unit of A and B are respectively Rs.30 and 20. Draw suitable diagram to show the feasible region. Also find the optimum allocation of units between A and B to maximize the total profit. Find the maximum profits by using graphical method.

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Q.2 :- Given the revenue and cost data below, obtain which product each plant should produce to maximize profit. Sales Revenue (Rs.000) Produces Production Cost.:-

Plant	Sales Revenue			
	1	2	3	4
A	50	68	49	62
B	60	70	51	74
C	55	67	53	70
D	58	65	54	69

Plant	Production Cost			
	1	2	3	4
A	49	60	45	61
B	55	63	45	69
C	52	62	49	68

D	55	64	48	66

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Q. 3 :- Solve the following transportation problem using Vogel's Approximation Method :-

To / From	W_1	W_2	W_3	W_4	Supply
F_1	7	4	5	6	34
F_2	5	5	7	6	15
F_3	8	6	6	6	12
F_4	6	3	6	4	19
Demand	21	25	17	17	80

Use Vogel's approximation method to determine the transportation cost schedule which minimizes the distribution cost.

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Q.4 :- A small project consisting of eight activities as the following characteristics ;-

Activity Code	Name	Most Optimistic time (t_0)	Most likely time (t_m)	Most Pessimistic time (t_m)
1-2	A	8	8	8
1-3	B	3	8	27
2-4	C	3	8	21
2-5	D	1	2	4
3-5	E	10	10	10
4-5	F	1	2	4
4-6	G	3	8	9
5-6	H	1	3	5

Determine :-

(i) Draw the PERT, network for the project.

(ii) Critical Path.

(iii) Duration of the project.

(iv) Find the probability of completing the project not more than 29 weeks later than expected.

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Q.5 :- The The Branch of Maharashtra Bank has only one typist. Since the typing work varies in length. (No. of pages is to be typed.) The rate is randomly distributed approximately the Poisson distribution, with mean service rate of 8 letter/nour. The letters arrive at a rate of 5 letters/hour, during the entire 8 hours day. If the typewriter is paid at Rs.1.50/hour, determine :-

(a) Equipment utilization.

(b) The % time that the average arriving has to wait.

(c) Average system time

(d) Average cost due to waiting on the part of typewriter.

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Q. 6:- A publishing house purchase 2000 units of a particular item per year at a unit cost of Rs.20, the ordering cost per order is Rs.50 and the inventory carrying cost is 25 per cent. Find the optimal order quantity and minimum total cost including purchases cost.

It a 3 percent discount is offered by the supplier for purchases in lots 1000 or more, should be publishing house accept the proposal?

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Q.1 :- A small manufacturing firm produces two types of products A and B, which are first processed in the foundry, then sent to the machine shop for finishing. The number of man-hours of Labour required in each shop for the production of each unit of A and B and the number of man hours the firm has available per week are as follows :-

Particulars	**Foundry Man hours**	**Machine Shop Man hours**
Product A	10	5
Product B	5	4
Machine capacity per week	100	60

The profit on the sale of A is Rs.30 per units as compared with Rs.20 per unit of B. The problem is to determine the weekly production of Product A and B, so that the total profit is maximized. (Use graphical method.)

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Q.2 :- A dairy firm has three plants located through a state.

Daily Milk Production at each plant is as follows :-

Plant (P_1) -- 25 Million litres.
Plant (P_2) -- 25 Million litres.
Plant (P_3) -- 10 Million litres.

Each day the firm must fulfil the needs of its four distribution centres. Minimum requirements at each centre is as follows :-

Distribution centre (D_1) -- 20 Million litres.
Distribution centre (D_2) -- 15 Million litres.
Distribution centre (D_3) -- 15 Million litres.
Distribution centre (D_4) -- 10 Million litres.

Cost of shipping one million litre of milk from each plant to each distribution centre is given in the following table in hundred of Rupees :-

Plants	**Distribution Centers**			
	D_1	**D_2**	**D_3**	**D_4**
P_1	7	3	3	5
P_2	9	8	8	4
P_3	5	6	6	10

Use Vogel's Approximation Method to determine optimum transportation schedule which minimizes total transportation cost.

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Q.3 :- The captain of an Indian Cricket Team has to allot five middle batting positions to five batsmen. The average runs scored by each batsmen at these positions are as follows :

Batsmen	Batting Positions				
	I	**II**	**III**	**IV**	**V**
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

Find the assignment of batsmen to position which would give the maximum number of runs.

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Q.4 :- A project has following activities of repairing work ;-

Activity Code	Activity Name	Durations in days
1-2	A	3
2-3	B	4
2-4	C	3
2-5	D	8
3-6	E	4
4-6	F	6
5-7	G	5
6-7	H	3

Determine :-

(a) Draw the network diagram. (b) Find Critical Path.

(c) Indicate the EST, LST of each node. (d) Find Total, Free and Independent Float.

(e) Duration of project in days.

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Q.5 :- Novelty Ltd. carries a wide assortment of items for its customers. One item, Gaylook, is very popular. Desirous of keeping its inventory under control, a decision is taken to order only the optimal economic quantity, for this item, each time. You have the following information :

Annual demand	1,60,000 units
Price per unit	Rs.20
Carrying cost (Holding cost)	Rs.1 per unit or 5% rupee of Inventory value
Cost per order	Rs.50

Calculate :-(a) Economic Order Quantity (EOQ) (b)Optimum numbers of order

(c) Time between two consecutive orders (d) The optimal cost (TESC.)

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Q.6 :- Customers arrive at a one window drive in bank according to Poisson distribution with a mean 10 per hour. Service time per customer is exponential with mean 5 minutes. The space in front of the window including that for the serviced car, can accommodate a maximum of 3 cars. Other car can wait outside this space.

(a) What is the probability that an arriving customer can drive directly to the space in front of the window?

(b) What is the probability that an arriving customer will have to wait outside the indicated space?

(c) How long is an arriving customer expected to wait before starting service?

(d) How many spaces should be provided in front of the window so that all the arriving customers. Can wait in front of the window at least 20% of the time?

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